

REMARKS

Claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135, and 144-155 are pending in this application. By this amendment, the Applicant has amended claims 1, 19, 23, 31, 49, 50, 59, 77, 101, 113, 131, and 155 without prejudice. The Applicant respectfully submits that claims , 19, 31, 49, 59, 101, 113, and 131 do not contain new matter and that the invention, as defined by claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135, and 144-155 is patentable over the prior art. .

I. THE 35 U.S.C. §112 REJECTIONS – WRITTEN DESCRIPTION AND INDEFINITENESS

The Examiner rejected claims 77, 78, and 155 under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement and the enablement requirement. Specifically, the Examiner stated: “[c]laims 77 and 155 each recite ‘a cone-shaped vapor orifice’. Because the parent claim already set the limitations of a ‘nosecone’, there is no support of this additional limitation in the Specification to have both a nosecone and a cone-shaped vapor orifice.” (Office Action dated July 19, 2010, page 3).

The Examiner also rejected claims 19, 101, and 131 under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Specifically, the Examiner stated: “[c]laim 101 recited the limitation ‘said cone-shaped vapor orifice’ in line 7 on page 20. There is insufficient antecedent basis for this limitation in the claims. Similarly, claim 131 and 19 each recites ‘said cone-shaped vapor orifice’. Claims 19, 101, and 131 will be examined as ‘said nosecone’”. (*Id.*)

As noted above, claims 19, 77, 78, 101, 131, and 155 have been amended in order to overcome the 35 U.S.C. § 112, first and second paragraph rejections. For example, claim 19 has been amended to require “said bore is conically shaped.” Claims 77, 78, 101, 131, and 155 have been amended to require “said nosecone.” Applicant respectfully submits that the aforementioned amendments to the claims provide the clarification sought by the Examiner. In view of the foregoing, Applicant respectfully requests that the Examiner’s 35 U.S.C. §112 rejection of claims 19, 77, 78, 101, 131, and 155 be withdrawn.

II. THE 35 U.S.C. § 103 REJECTION OVER SAITO, AAPA, DELANGE, MERCER, KRITZER, COLOMBO, DAVID, FINICLE, BULLOUGH, BAHNEY, UENO, LEYCURAS, NATELSON, AND BACCHI

The Examiner rejected claims 1-2, 8-17, 19, 40, 43-45, 47-51, 55, 66-78, 92, 95-97, 99-100, 153, and 155 under 35 U.S.C. § 103(a) as being unpatentable over Saito, Japanese Pat. No. JP 62-237721 (hereinafter “Saito”), in view of Applicant Admitted Prior Art (hereinafter “AAPA”), in view of DeLange, U.S. Patent No. 2,508,500 (hereinafter “DeLange”), in view of Mercer, U.S. Patent No. 5,407,000 (hereinafter “Mercer”), and in further view of Kritzer, U.S. Patent No. 3,133,430 (hereinafter “Kritzer”). The Examiner also rejected claims 101-105, 107, 109, 115-116, 118-131, 144, 147-149, 151-152, and 154 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, and Kritzer, further in view of Colombo, U.S. Patent No. 5,827,371 (hereinafter “Colombo”). The Examiner rejected claims 3, 18, and 52-53 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer and Kritzer further in view of David, U.S. Patent No. 4,672,813 (hereinafter “David”). The Examiner further rejected claim 106 under 35 U.S.C. § 103(a) as being unpatentable over Saito,

AAPA, DeLange, Mercer, Kritzer and Colombo, further in view of David. The Examiner also rejected claims 4 and 54 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer and Kritzer, further in view of Finicle, U.S. Patent No. 5,158,750 (hereinafter “Finicle”). The Examiner rejected claim 108 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, Kritzer and Colombo, further in view of Finicle. The Examiner also rejected claims 21-22, and 56-57 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer and Kritzer, further in view of Bullough et al., U.S. Patent No. 4,072,599 (hereinafter “Bullough”). The Examiner rejected claims 110 and 111 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, Kritzer and Colombo, further in view of Bullough. The Examiner also rejected claims 23-24, 26-27, 58-59, and 112-113 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, Kritzer and Bullough, further in view of Colombo and Bahney, U.S. Patent No. 2,195,071 (hereinafter “Bahney”). The Examiner rejected claims 63-65 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer and Kritzer, further in view of Ueno, U.S. Patent No. 6,279,330 (hereinafter “Ueno”). The Examiner rejected claim 28 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, Kritzer and Bullough, further in view of Ueno. The Examiner also rejected claim 117 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, Kritzer, Bullough and Colombo, further in view of Ueno. The Examiner also rejected claims 29-31, and 81-83 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer and Kritzer, further in view of Leycuras, U.S. Pat. App. Pub. No. 2004/0238526 (hereinafter “Leycuras”). The Examiner further rejected claims 133-135 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, Kritzer, Bullough and Colombo, further in view of Ueno.

The Examiner rejected claims 41-42, 46, 93-94 and 98 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer and Kritzer, further in view of Natelson, U.S. Patent No. 3,687,632 (hereinafter “Natelson”), in further view of Bacchi et al., U.S. Pat. App. Pub. No. 2003/0055533 (hereinafter “Bacchi”). The Examiner also rejected claims 145-146, and 150 under 35 U.S.C. § 103(a) as being unpatentable over Saito, AAPA, DeLange, Mercer, Kritzer, Bullough, and Colombo, further in view of Natelson and Bacchi. The Applicant respectfully traverses the Examiner’s rejections, and submits that Saito, AAPA, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi, alone or in combination, do not teach, suggest, or render obvious all of the limitations as required in claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135 and 144-155.

As noted above, Applicant has amended claims independent claims 1, 49, and 101 so as to more clearly distinguish the invention, as defined by such claims, over the prior art. Applicant submits that support for the limitations in independent claims 1, 49, and 101 is expressly or inherently disclosed in the specification of U.S. Patent Pub. No. 2005/0229856 (Application No. 10/829,148) in at least paragraphs [0068], [0072], and [0093] and Figures 5, 7A, and 7B.

The present invention, as disclosed in independent claims 1 and 101, contains similar limitations and are thus addressed together, is a liquid metal evaporation source for use in Molecular Beam Epitaxy or a vacuum deposition process. For example, the invention of claim 1 requires, among other things, “a nosecone coupled to said evaporator, said nosecone comprises a solid cylindrical body having a tapered bore from a first opening on said solid cylindrical body adjacent to said liquid metal to a second opening on said solid cylindrical body remote from said liquid metal, and at least one annular ring coupled to an external surface at said second opening,

wherein said nosecone disperses said evaporated liquid metal from said first opening to said second opening”, and “wherein said evaporator, said hollow reservoir cylinder, and said hollow transport tube form a unitary body machined from a single piece of refractory material.”

Independent claim 101 also requires, among other things, “a nosecone coupled to said evaporator, wherein said nosecone comprises a solid cylindrical body . . .”, and “wherein said evaporator, said reservoir, and said transport tube form a unitary body machined from a single piece of material.” These limitations are not taught anywhere in DeLange, AAPA, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi teach these features.

Applicant’s invention as described in the specification of the invention is a liquid metal evaporation source for use in Molecular Beam Epitaxy and related metal vacuum deposition techniques. (U.S. Patent Pub. No. 2005/0229856, Abstract). The invention includes an evaporator, maintained at a high temperature, to evaporate a liquid metal and a reservoir maintained at a temperature above the melting point of the metal for holding the liquid metal source while a hollow transport tube is provided for connecting the evaporator and the reservoir. (U.S. Patent Pub. No. 2005/0229856, Abstract). A nosecone and level sensor is inserted into the evaporator. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). The nosecone is a solid cylindrical body comprising a tapered orifice for dispersing evaporated liquid metal at an optimum thickness while also providing low consumption of the liquid metal in the evaporation process. (U.S. Patent Pub. No. 2005/0229856, paragraph [0071]; Figure 5, 7A). Further, the evaporator, hollow transport tube, and reservoir cylinder are machined from a single piece of refractory material. (U.S. Patent Pub. No. 2005/0229856, paragraph [0068]).

Saito merely teaches an electrode disposed inside a liquid metal in a molecular beam source cell. (Saito, Detailed Description). The Saito system employs the source cell to deposit evaporated liquid metal onto a substrate through evaporation. (Saito: page 5; figure 1). Also, an electrode resides inside the liquid, near the opening of the cell, to detect the liquid level of the source cell. (Saito, page 5, figure 1). However, Saito does not teach or suggest “a nosecone coupled to said evaporator, said nosecone comprises a solid cylindrical body having a tapered bore . . .” Nor does Saito teach or suggest that the evaporator, transport tube, and reservoir from a unitary body, as is required in Applicant’s claims 1 and 101.

Applicant respectfully submits that AAPA does not teach or suggest the nosecone of claims 1 and 101. Indeed, AAPA teaches away from Applicant’s invention by disclosing a conical nosecone and not Applicant’s nosecone made from a solid cylindrical body having a tapered bore. The nosecone of the present invention has a solid body and includes a tapered opening around the solid body to provide low consumption of the liquid metal. Nor does AAPA teach or suggest that the evaporator, transport tube, and reservoir from a unitary body, as is required in Applicant’s claims 1 and 101.

Further, DeLange merely discloses a heating element in an intermediary tube transporting the liquid for heating the liquid. (DeLange, figure 3; column 3, line 53-59). A heating element is provided for maintaining the metal in a molten state. (DeLange, column 5, line 40-59). More importantly, DeLange does not teach or suggest “a nosecone coupled to said evaporator, said nosecone comprises a solid cylindrical body having a tapered bore . . .” Nor does DeLange teach or suggest that the evaporator, transport tube, and reservoir from a unitary body, as is required in Applicant’s claims 1 and 101.

Further, Mercer teaches a thermocouple for measuring the temperature of molten metal for the purpose of temperature control. (Mercer, column 3, line 58-60). However, Mercer too does not teach or suggest the nosecone with a tapered bore or that the evaporator, transport tube, and reservoir from a unitary body, as is required in Applicant's claims 1 and 101.

Kritzer teaches a refrigerating system comprising tubing stock to connect the evaporator to the accumulator and condenser. (Kritzer, figure 1 and 2). The tubing stock in Kritzer is provided to eliminate possible leaks in refrigerating system. (Kritzer, column 2, line 21-24). However, Kritzer also does not teach or suggest Applicant's nosecone or unitary body.

Colombo teaches a crucible comprising a cylindrical body and a conical insert having a pronounced positive draft. (Colombo: column 5, line 7-25). Also, differential heating provided by the dual filaments minimizes hydrodynamic instability and rapid depletion effect common in other hot lip source designs. (Colombo: column 5, line 26-29). David merely teaches densified graphite as being useful for high temperature resistance and low thermal expansion, (David: column 1 lines 50-53), while Finicle and Bullough also teach using pyrolytic graphite and densified graphite respectively for refractory materials. (Finicle: Abstract; Bullough: Abstract). More importantly, Colombo, David, Finicle, and Bullough also does not teach or suggest "a nosecone coupled to said evaporator, said nosecone comprises a solid cylindrical body having a tapered bore . . ." or that the evaporator, transport tube, and reservoir from a unitary body, as is required in Applicant's claims 1 and 101.

In light of the comments above, the Applicant submits that Saito, AAPA, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi, alone or in combination, fail to teach, render obvious, or even suggest, the features of

claims 1 and 101. The Applicant respectfully asserts that claims 1 and 101 are patentable over the cited references.

Further, as claims 2-4, 8-19, 21-24, 26-31, 40-48, 153, and 155 depend either directly or indirectly from independent claim 1 and claims 102-113, 115-131, 133-135, and 144-154 depend either directly or indirectly from independent claim 101, they contain all of the elements and limitations of the claim from which they depend. Claims 2-4, 8-19, 21-24, 26-31, 40-48, 102-113, 115-131, 133-135, and 144-155 are therefore, patentable over Saito, AAPA, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi for at least the same reasons as independent claims 1 and 101. Therefore, the Applicant respectfully requests that the Examiner withdraw the 35 U.S.C. § 103(a) rejection of claims 2-4, 8-19, 21-24, 26-31, 40-48, 102-113, 115-131, 133-135, and 144-155. Referring finally to independent claim 49, Applicant points out that the limitations of claim 49 are analogous to those discussed above for claims 1 and 101. As was discussed regarding, Applicant's invention is a liquid metal evaporation source for use in Molecular Beam Epitaxy and related metal vacuum deposition techniques. (U.S. Patent Pub. No. 2005/0229856, Abstract). The invention includes an evaporator, maintained at a high temperature, to evaporate a liquid metal and a reservoir maintained at a temperature above the melting point of the metal for holding the liquid metal source while a hollow transport tube is provided for connecting the evaporator and the reservoir. (U.S. Patent Pub. No. 2005/0229856, Abstract). A nosecone and level sensor is inserted into the evaporator. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). The nosecone is a solid cylindrical body comprising a tapered orifice for dispersing evaporated liquid metal at an optimum thickness while also providing low consumption of the liquid metal in the evaporation process. (U.S. Patent Pub. No. 2005/0229856, paragraph [0071]; Figure 5, 7A).

Saito merely teaches an electrode disposed inside a liquid metal in a molecular beam source cell. (Saito, Detailed Description). The Saito system employs the source cell to deposit evaporated liquid metal onto a substrate through evaporation. (Saito: page 5; figure 1). Also, an electrode resides inside the liquid, near the opening of the cell, to detect the liquid level of the source cell. (Saito, page 5, figure 1). However, Saito does not teach or suggest “a nosecone coupled to said evaporator, said nosecone comprises a solid cylindrical body having a tapered bore . . .” as is required in Applicant’s claim 49.

Also, AAPA does not teach or suggest the nosecone of claim 49. Indeed, AAPA teaches away from Applicant’s invention by disclosing a conical nosecone and not Applicant’s nosecone made from a solid cylindrical body having a tapered bore. The nosecone of the present invention has a solid body and includes a tapered opening around the solid body to provide low consumption of the liquid metal.

Further, DeLange merely discloses a heating element in an intermediary tube transporting the liquid for heating the liquid. (DeLange, figure 3; column 3, line 53-59). A heating element is provided for maintaining the metal in a molten state. (DeLange, column 5, line 40-59). More importantly, DeLange does not teach or suggest “a nosecone coupled to an evaporator, with the nosecone comprising a solid cylindrical body having a tapered bore, as is required in Applicant’s invention.

Further, Mercer teaches a thermocouple for measuring the temperature of molten metal for the purpose of temperature control. (Mercer, column 3, line 58-60). However, Mercer too does not teach or suggest the nosecone comprising a solid cylindrical body and having a tapered bore.

Kritzer teaches a refrigerating system comprising tubing stock to connect the evaporator to the accumulator and condenser. (Kritzer, figure 1 and 2). The tubing stock in Kritzer is provided to eliminate possible leaks in refrigerating system. (Kritzer, column 2, line 21-24). However, Kritzer also does not teach or suggest Applicant's nosecone.

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III. CONCLUSION:

In view of the foregoing, the application is deemed to be in condition for allowance and action to that end is respectfully requested.

Should any changes to the claims and/or specification be deemed necessary to place the application in condition for allowance, the Examiner is respectfully requested to contact the undersigned attorney to discuss the same.

Respectfully Submitted,

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